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INTERNATIONAL ORGANIZATIONS' ROLE IN DEVELOPMENT OF PHARMACEUTICAL INDUSTRIES IN THE ARAB WORLD *

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1.0 GENERAL

Since health is a basic human need and pharmaceutical products directly affect the health of a nation, they have a greater social relevance than the products of almost any other industry. The pharmaceutical products, therefore, constitute an essential element in health care system. In view of this, the availability of pharmaceuticals assumes significance. At this juncture, it may be pertinent to look at the per capita drug consumption figures of different countries (please see annex 1). These figures show a clear demarcation between the developed and developing countries as far as per capita drug consumption is concerned. While the per capita consumption of drugs in developed countries ranged from US$ 13 to 52, the corresponding figues for developing countries ranged from US$ 0.8 to 18. This is inspite of the fact that many developing countries spend over 50 percent of their health budget on drugs. During 1982, the developing countries with 74 percent of the world's population had only 21.8 percent share of the global consumption of pharmaceuticals. In fact 75 - 80 percent of the population in developing countries have practically no access to modern drugs. It is, therefore, obvious that developing countries should formulate policies that ensure an adequate supply of reasonably priced pharmaceuticals to their population.

1.1 WORLD PHARMACEUTICAL PRODUCTION

During 1977, the share of developing countries in world production of pharmaceuticals amounted to 11.4 percent (please see Annex 2). Out of this the share of Asia was 5.6 percent while that of Africa amounted to only 0.5 percent. During 1982, the production of pharmaceuticals in developing countries was valued at US$ 15.1 billion, which corresponded to 17.8 percent of the world output, while their consumption was 21.8 percent during the same period. The imbalance was obviously made up through imports.

1.2 SPECIAL FEATURES OF THE PHARMACEUTICAL INDUSTRY TODAY

The pharmaceutical industry usually ranks first or second amongst all industries in profitability since the mid-1950s.[1] For example, in the United States and the United Kingdom, the industry as a whole earned 21 percent and 26 percent

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[1] The pharmaceutical industry and dependency in the Third World. G. Gereffi, Princeton University Press, 1983

respectively on capital employed in the latter part of the 1960s as compared with 13 percent for all manufacturing in both countries. In the 1970s, the United States Drug companies frequently earned over 50 percent profits as a percentage of networth. This situation characterizes countries such as th United States, Great Britain, Switzerland, France, the Federal Republic of Germany and Japan. These countries are also the Vanguard of innovation in the pharmaceutical industry and invested large amounts in Research and Development. Such innovation became possible in these countries due to:

- very costly experimental and clinical research programmes to develop new programs;
- strong basic chemical industry;
- an extensive university network to provide a continuing supply of well trained technicians and scientists,
- an advanced heavy industry to supply necessary equipment and machines;
- an active and competent state regulatory apparatus to ensure the quality and safety of the pharmaceuticals produced;
- large high-income consumer markets to generate the demand to buy new drugs.

The above describes the situation existing in the advanced industrialized countries but does not necessarily follow that these are the essential prerequisites for the development of the pharmaceutical industry especially in developing countries.

1.3 OVERVIEW OF THE PHARMACEUTICAL INDUSTRY IN DEVELOPING COUNTRIES

Based on the level of development of the pharmaceutical industry, developing countries can be classified into five different stages of vertical integration (please see annex 3). The countries in the first stage rely entirely on imports of pharmaceuticals in dosage form, since they have no pharmaceutical manufacturing activity. Those in the second and third stages of development import bulk drugs (pharmaceutical chemicals) and produce pharmaceuticals in dosage form. They have no facilities to produce pharmaceutical chemicals. The countries in the fourth and fifth stages have the highest degree of vertical integration. Besides producing pharmaceuticals in dosage form, they manufacture a fairly broad range of pharmaceutical chemicals from intermediates and raw materials. India, Mexico, Brazil, Argentina and Egypt are in the fifth stage. These countries are also characterised by local research and development to some extent. It is observed from annex 3 that amongst developing countries, the pharmaceutical industry is most developed in Latin

America, less advanced in Asia and the Middle East and least developed in Africa.

The degree of domestic ownership in developing countries' pharmaceutical industries is relatively low (please see annex 4). An examination of the pharmaceutical market share in 25 selected countries in 1975 shows that the domestic share held by developing countries is less than 35 percent.[2]

1.4 STATUS OF THE PHARMACEUTICAL INDUSTRY IN THE ARAB WORLD

An examination of annex 3 shows that amongst developing countries surveyed except one country, the rest of the Arab countries belong to the first three stages of development of pharmaceutical industry. The latter in most of the countries is, therefore, limited to the production of pharmacueticals in dosage form based on pharmaceutical chemicals. The number of formulation plants in these countries totalled 39 in 1977 (please see annex 5). Together these plants produced 40 percent of the pharmaceutical dosage forms consumed. However, the actual percentage of local production in individual countries varied from 0 to 86 percent.

A few of the Arab countries produce pharmaceutical chemicals required by the local pharmaceutical dosage production units. For example, El Nasr company of Egypt, produces a wide range of pharmaceutical chemicals through chemical synthesis (please see annex 6). Although El Nasr company has limited facilities for fermentation, there is no production of antibiotics based on fermentation. Tetracycline hydrochloride is produced from imported Tetracycline base; Procaine and Benzathine penicillins are produced from imported potassium penicillin. Three companies in Egypt have facilities for producing active principles of medicinal plants and have been exporting substantial quantities of the same. For example, Ammodin (xanthotoxin) is isolated from Ammi majus seeds. Besides about 60.000 litres of crude extrats are prepared from plants and these include liquorice extract, Belladonna extract, Valeriana, Gentian and Rhubarb extracts. In Egypt, aromatic industry is also well developed producing essential oils and oleoresins used in perfumery, cosmetics and food flavours (please see annex 7). Algeria has a big programme for the production of antibiotics. In Iraq there are limited fermentation facilities for the production of antibiotics and extracts from medicinal plants. A large antibiotics plant is under establishment.

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2 Ibid

2.0 PROJECTS IN THE PHARMACEUTICAL SECTOR IMPLEMENTED BY UNIDO IN THE ARAB COUNTRIES

Based on an agreement with the Arab company for Drug Industries and Medical Appliances (ACDIMA) a team of seventeen international experts was assembled by UNIDO in 1977 to survey the situation in different countries and to prepare in detail a production programme for the production of drugs, packaging materials and medical appliances. This led to the preparation of an integrated production plan for the Arab Pharmaceutical Industry.[3] This plan contained recommendations outlining the appropriate measures to be undertaken by ACDIMA in the short term as well as the long term for the implementation of the above plan. Additional survey and feasibility studies carried out during 1977-1984 are indicated in annex 8.

3.0 DEVELOPMENT OF THE PHARMACEUTICAL INDUSTRY IN DEVELOPING COUNTRIES - SPECIAL CONSIDERATIONS

It is but natural that the economic viability of the pharmaceutical industry in developing countries is looked upon like any other industry or for that matter like the pharmaceutical industry in the advanced industrialised countries. As indicated in para 1.2 above, the pharmaceutical industry in developed countries is characterised by large market, elaborate research and development complex, availability of highly skilled technicians and scientists, existence of a strong chemical and machine fabricating industries etc, etc... Since, most of developing countries are characterised by the absence of these very factors, one is tempted to conclude that the pharmaceutical industry in developing countries is unlikely to be economically viable. Finally, it is argued that pharmaceuticals are available on the international market at competitive prices and it is, therefore, more economical to import rather than take up local production. However, there are other more compelling factors, which have to be taken into account while dealing with the development of pharmaceutical industry in developing countries and these are discussed briefly below:

3.1 SOCIAL BENEFITS

As indicated earlier, since pharmaceuticals directly affect the health of a nation, they have greater social relevance than most other industrial products. Modern medicines have helped to control several diseases that once were the leading causes of death, such as tuberculosis, pneumonia, cholera, typoid, smallpox, polio,

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[3] Production plan for the Arab Pharmaceutical Industry in selected Arab countries UNIDO/IOD/299, 1978.

cardio-vascular diseases and to a limited extent cancer. The medicines thus have helped prolong and improve the quality of life for millions of people throughout the world. When one recognises that only 20-25 percent of the population in developing countries has access to modern medicines, there is an urgent need to augment the supplyof pharmaceuticals to reach a larger segment of population.

3.2 SELF RELIANCE

As in the case of food, self reliance is vital in the case of pharmaceuticals. Two recent instances highlight the importance of self reliance. During 1983, an earth quake occured in a least developed country and a UNIDO assisted pilot plant was the only facility available in the country which worked round the clock to supply essential drugs. Imports would have taken not less than a week and this would have meant loss of several lives. In another developing country, an emergency situation required intravenous fluids immediately and it took five days to import from Europe and then it was too late. In view of this, one cannot consider pharmaceutical industry development in economic terms alone.

3.3 COST-EFFECTIVENESS OF PHARMACEUTICALS

Recent studies relating to the cost-effectiveness of vaccines, beta blockers and other drugs showed that drugs are an economical form of medical therapy and that they can substantially reduce overall health-care costs.[4] When one recognizes that nearly 50 percent of the health budget in several developing countries is accounted by drugs, their cost-effectiveness assumes greater significance. For example, the study referred to above showed that the benefit-cost ratio for measles immunization in Yaoundé, Cameroon was 33:1. Similar observations were made in the case of antibiotics, beta blockers and anti-ulcer medicines where in the cost-effectiveness was considerable.

3.4 OTHER BENEFITS

Other benefits derived from the establishment of the pharmaceutical industry in developing countries are employment apportunities, manpower development, export possibilities, economizing on foreign exchange through local production and minimizing imports, utilization of natural resources and local raw materials and development of ancillary industries etc, etc....

In the light of above, it is obvious that there are several special considerations which favour the development of the pharmaceutical industry in developing countries.

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[4] Cost-effectiveness of pharmaceuticals. Pharmaceutical Manufacturers Association, 1984, Washington D.C, U.S.A.

4.0 STRATEGY FOR THE DEVELOPMENT OF THE PHARMACEUTICAL INDUSTRY IN THE ARAB WORLD

From the foregoing, it is obvious that the development of Pharmaceutical Industry has considerable relevance to the situation in the Arab World. The integrated development of this industry in this region would create vital and strategic health-related industries having direct impact on the socio-economic development of one of the most important regions of the world. Such a development can be achieved through a concerted action in different areas as described below briefly:

4.1 PRODUCTION OF PAHRMACEUTICALS IN DOSAGE FORM

As indicated earlier in para 1.4, the existing formulation plants in the Arab countries produce about 50 percent of their needs. The technology involved in the production of pharmaceuticals in dosage form is relatively simple and is well diffused. This type of industry is also characterized by licencing arrangements, foreign subsidiaries and joint ventures. In view of this, it is appropriate to expand the capacity of pharmaceutical dosage form production. A projection based on 1977 production showed that approximately 35 formulation plants should be built additionally to meet 44 percent of the Arab countries' needs by 1985.[5] The new plants should also cover large volume parenterals and small volume parenterals and veterinary formulations. It is also desirable that the location of new plants is complementary to improving existing plants. The Second UNIDO Consultation on the Pharmaceutical Industry in 1983 concluded that where a country decided to establish or expand manufacturing of formulation capacity of specific products, it was appropriate for UNIDO to make available advice and assistance in the selection and acquisition of technologies, preparation of feasibility studies, obtaining of investment finance and, more generally, establishment of manufacturing capacity including the training of manpower.[6] To promote industrialization in the pharmaceutical sector, UNIDO has prepared a series of technical profiles offering guidance to developing countries in the establishment of units for production of phamaceutical dosage forms.[7] The UNIDO Directory of sources of supply assists developing countries in locating suitable sources of supply for the pharmaceutical industry.[8]

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5 Production Plan for the Arab Pharmaceutical industry in selected Arab Countries Ibid.

6 Second Consultation on the Pharmaceutical Industry. UNIDO/ID/311, 1983.

7 Technical profiles for production of pharmaceutical dosage forms, NIDO/IO/WG. 393/4, 1983.

8 Directory of Sources of supply of 26 essential drugs, their chemical intermediates and some raw materials, UNIDO/ID/WG.393/2, 1983.

While planning production, it is desirable to select a product mix which renders the operations economically viable. It is heartening to note that considerable emphasis is being laid on GMP and Quality Assurance as is evident from the formulations units established in the region recently. Here is an area where technical co-operation between the Arab countries is possible and should be encouraged.

4.2 MANUFACTURE OF PHARMACEUTICAL CHEMICALS

Unlike in the case of production of pharmaceuticals in dosage form, the technology in the case of manufacture of pharmaceutical chemicals is rather sophisticated and is held by a limited number of technology holders. This is one of the reasons why very few developing countries have been able to make some headway in the area of manufacture of pharmaceutical chemicals. The availability, pricing and transfer of technology for bulk drugs formed one of the major issues of both the UNIDO consultations on the pharmaceutical industry held in 1980 and 1983 respectively.[9] The First Consultation recommended that mutually acceptable transfers of technology should be facilated through UNIDO providing reference information relevant to the transfer of technology, including technical aspects, such as level of production, magnitude of investments, inputs, infrastructure etc.. whichcould be a significant aid to individual developing countries in bilateral negotiations for transfer of technology. Subsequently UNIDO received certain offers of technology for the production of intermediates and bulk drugs. The second consultation recommended that in respect of offers of such technology, UNIDO should, in co-operation with technology holders, prepare feasibility studies at the request of interested countries. It can be seen from above that, UNIDO has been assigned an important role to facilitate the transfer of technology.

4.2.1 PHARMACEUTICAL CHEMICALS BASED ON FERMENTATION

The "wonder drug" penicillin developed during World War II led to the discovery of several life saving antibiotics. The antibiotic group constitutes the most important therapeutic group amongst drugs consumed in many of the developing countries and accounts for about 25 percent pf drug consumption. Except for a few, most of the developing countries entirely depend on imports of antibiotics in bulk as well as formulations to meet their demands. The recent advances in biotechnology and genetics engineering have opened up new venues for production of pharmaceutical products, vaccines, etc... In view of this, it is appropriate that the Arab countries take up and expand the manufacture of pharmaceutical chemicals based on

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9 First Consultation on the Pharmaceutical Industry, UNIDO/ID/259, 1980
Second Consultation on the Pharmaceutical Industry, Ibid

fermentation. As indicated earlier, some beginning was made in Egypt and Iraq during the sixties but this has not materialized significantly. Recently, a large antibiotics manufacturing complex has been established in Algeria. Another large complex is under establishment in Iraq. These plants could serve as nuclei for transfer of technology and training to other countries in the Arab world to facilitate the establishment of antibiotics plants in their respective countries.

4.2.2 PHARMACEUTICAL CHEMICALS BASED ON CHEMICAL SYNTHESIS - MULTI PURPOSE PILOT PLANT

An analysis of the Arab market reveals that many of the drugs are consumed in quantities not large enough to render the establishment of a seperate production unit economically viable. In view of this, it is appropriate to utilize the available facilities in Egypt and Iraq fully and to expand. At the same time, it is desirable to build a multi purpose pilot plant for the production of a group of synthetic drugs. Such a plant will facilitate the transfer of technology and its adaptation based on which single line production units or multi purpose plants to manufacture a group of drugs depending on their viability could be established. Multi purpose pilot plants of this type are being established under the auspices of UNIDO/UNDP in Cuba and Iran. These pilot plants will also facilitate training.[10]

Apart from above, with the development of petro-chemical industry in the Arab World, a number of chemicals are available, which could be used as such in the manufacture of synthetic drugs or in the production of intermediates required for the manufacture of such drugs. Thus, the establishment of facilities for the manufacture of pharmaceutical chemicals through chemical synthesis will facilitate the utilization of products from the petro-chemical industry.

4.2.3 PHARMACEUTICALS BASED ON MEDICINAL PLANTS

The Arab countries are very rich in plant resources, which can be exploited for industrial purposes. Because of wide variety of climatic and soil conditions, all types of medicinal plants of tropical, sub-tropical, temperate and mediterranean region can profitably be cultivated in one or the other Arab countries.

A close study of the available information on medicinal plants indicates that 21 species of medicinal plants occur in 13 Arab countries. Amongst these, according to scientific survey carried out, six of the plants are available in sizeable quantities from wild sources which can be used as raw material for a modern pharmaceutical industry. In view of this, an organization can be set up to process available

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[10] Multi purpose plant for production of UNIDO essential drugs based on raw material and intermediates, UNIDO/WG.393/18

medicinal plants as well as for producing such plants on a commercial scale. Simultaneously, cultivation on a scientific basis of medicinal plants should be undertaken. Applied research and development work should also be carried out to produce important drugs from medicinal plants for internal consumption. Analysis of the available information shows that phyto chemicals and crude extracts from medicinal plants are used extensively in different Arab countries. Nearly 20 pure chemicals and more than 80 crude extracts are found to be used in formulations marketed in the Arab countries, This shows that there is a ready market for local production (please see annexes 9 & 10). The Second Consultation on the Pharmaceutical Industry has given a mandate to UNIDO to intensify its programme in the area of medicinal plants.[11]

4.2.4 PRODUCTION OF BIOLOGICALS

The production of biologicals for the enhancement of preventive measures in the Arab countries assumes significance considering the efforts being made in this region toward Health care. Certain facilities and infrastructure in this sector already exist in the Arab world, for example, in Jordan, Egypt and Iran Existing facilities could be expanded to augment production as well as widen the range. New facilities could be established to meet the increasing demand. UNIDO has launched a programme on Industrial Utilization of Biologicals (IPB) and an Advisory Panel on Preventive Medicine has been established with high level representatives from both industry and government to guide the above programme. The Second Consultation on the Pharmaceutical Industry has given a mandate to UNIDO to undertake a wide ranging programme in the area of biologicals.[12]

4.3 THE STRENTHENING OF CAPABILITIES OF NATIONAL INSTITUTIONS IN THE AREA OF RESEARCH AND DEVELOPMENT

As indicated earlier, the pharmaceutical industry in the Arab World is mostly confined to the production of pharmaceuticals in dosage form (formulations) based on imported pharmaceutical chemicals. Technology for the production of formulations is relatively simpler and is well diffused. However, technology for the manufacture of pharmaceutical chemicals is more sophisticated and there are a limited number of technology holders from whom such technology is available. In view of this the development of the pharmaceutical industry in the Arab countries; as in the case of other developing countries depends to a considerable extent on the acquisition, adaptation and development of technology.

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11 Ibid

12 Ibid

4.3.1 PHARMACEUTICAL INDUSTRY RESEARCH AND DEVELOPMENT CENTRE

For the reasons mentioned in para 4.3 above, it would be appropriate to establish a Regional Pharmaceutical Industry Development Centre. Such a centre will have facilities in different disciplines for adaptation of technology, product development, engineering design and training. The organization set up of such a centre is shown in annex 11. This centre will also provide support to the existing pharmaceutical industry. Based on the technology and skills developed in the centre, facilities could be established for industrial scale production of pharmaceuticals in the Arab countries.

4.3.2 CENTRE FOR RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY AND GENETIC ENGINEERING

As indicated in para 4.2.1 above, the use of living organisms or their components in industrial processes - biotechnology has made significant progress with the development of genetic engineering. The latter enables the manipulation of the genetic material of the micro-organisms to produce the desired characteristics or abilities. Within the last eight years, this development has led to several practical applications, such as: microbial production of himan insulin, growth hormones and interferons. Human insulin is currently being marketed in Europe and will be released soon in the U.S.A. Rapid progress is also being achieved in the area of vaccines, blood replacement products and immune stimulating products. Similar products meant for veterinary use can have significant impact on meat production. This field has also application in the area of agriculture.

In view of the immense possibilities and potentials in the area of biotechnology and genetic engineering, it is appropriate that an important sub-region such as the Arab world should have a centre. A sub-regional centre for Research and Development of Biotechnology and Genetic Engineering is being established in Mexico, under the auspices of UNDP/UNIDO and the government of Mexico. [13]

5.0 ANCILLARY INDUSTRIES

The pharmaceutical industry in many of the Arab countries is limited by the lack of local industry for the production of miscellaneous items such as glass and plastic containers and other packaging materials. The integrated development of the pharmaceutical industry should, therefore, include the establishement of ancillary industries to meet the requirements on a regional basis. It is therefore, appropriate

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13 DP/RLA/83/003 Centre for Research and Development in Biotechnology and genetics for Pharmaceutical Products.

that pharmaceutical glass container projects, empty gelatin capsules projects etc.. should be set up paralelly with the development of the pharmaceutical Industry in the Arab countries. It is heartening to note that projects for the production of pharmaceutical glass and pharmaceutical capsules have been taken up in Egypt and feasibility study for a pharmaceutical glass container project has been carried out in Syria.

6.0 TECHNICAL COOPERATION AMONGST DEVELOPING COUNTRIES (TCDC)

In view of the complex technology involved in the production of pharmaceutical chemicals and the limited number of sources available for the acquisition of such technology, TCDC assumes significance. Fortunately, some of the developing countries in the Arab world as well as outside are relatively more "advanced" than others in the technological field and they would be in a position to assist sister developing countries. As already mentioned, a multi purpose pilot plant for the production of 15 pharmaceutical chemicals through chemical synthesis is at an advanced stage of establishment in Cuba with technical know-how from India. Similar possibilities exist within the Arab world itself.

ANNEX 1

Per Capita Drug Comsumption of Selected Countries

(dollars of the period)

	Year	Per capita drug consumption (in US$)	Population (in millions)
Developing Countries			
Algeria	1976	8.2	16.23
Afghanistan	1976	1.2	14.00
Argentina	1975	18.0	25.38
Bangladesh	1976	0.9	80.40
Brazil	1976	12.0	109.96
Chad	1977	0.8	4.2
China	1975		822.8
Egypt	1977	5.5	38.08
Ethiopia	1978	0.8	2.86
Guinea	1977	1.7	5.7
India	1977	1.6	620.44
Indonesia	1976	1.8	135.19
Iran	1977	14	34.3
Korea, Rep of	1977	14	35.96
Libyan Arab Jamahriya	1975	9.9	2.44
Malaysia	1977	2.5	12.65
Mexico	1976	11.6	62.05
Nigeria	1977	2.75	77.05
Pakistan	1976	1.3	71.30
Peru	1975	9.6	15.38
Sudan	1977	5.6	15.8
Thailand	1976	5.75	42.96
Tanzania	1976	1.3	15.1
Turkey	1975	4.1	40.1
Developed Countries			
Austria	1975	26	7.5
Belgium	1975	42	9.8
Canada	1976	28	23.18
Denmark	1976	28	5.07

Annex 1 (continued)

Country	Year	Per capita drug consumption (in US$)	Population (in millions)
Developed Countries (Cont.)			
Finland	1976	36	4.73
France	1976	50	52.92
FR Germany	1976	52	62.00
Greece	1976	24	9.13
Ireland	1976	13	3.16
Italy	1976	34	56.19
Japan	1976	41	112.77
Netherlands	1976	26	13.77
Norway	1976	24	4.03
Spain	1976	36	35.70
Sweden	1975	36	8.22
Switzerland	1975	35	6.41
U.K	1976	18	56.07
U.S.A	1976	33	215.12
Centrally Planned			
Czechoslovakia	1975	27	14.80
Hungary	1975	28	10.54
Poland	1975	14	34.02
USSR	1975	9	254.39

Source: Population data from World Bank Atlas 1977
UNIDO case studies on developing countries and ACDIMA: "Arab Pharmaceutical Consumption and Industries".

Annex 2

Production of Pharmaceuticals
and share by regions
(1977)

	US$ 10^6	% Share of Production
Developed Countries		
Market Economies		
North America	14 369	25.14
Western Europe	21 196	37.09
Others	9 247	16.18
Centrally Planned Economies		
Eastern Europe	12 331	21.58
Total Developed Countries	57 143	88.55
Developing Countries		
Africa	364	0.56
Asia (excluding China)	3 621	5.61
Latin America	3 397	5.26
Total Developing Countries	7 382	11.43
World Total	64 525	

Source: UNIDO

Annex 3

Levels of Development of the Pharmaceutical Industry in Third World Countries, 1979

Stage of Pharmaceutical Production	Africa	Latin America	Asia	Middle East
Group 1: Countries that have no manufacturing facilities and are therefore dependent upon imported pharmaceuticals in their finished form. In many of these countries there is insufficient trained personnel, limited public health services, and poor distribution channels.	Burundi Central African Republic Chad Lesotho Rwanda Sierra Leone Somalia Swaziland Togo Uganda Zambia	Honduras	Bhutan Mongolia	Yemen
Group 2: Countries that have started to repack formulated drugs and process bulk drugs into dosage forms.	Ivory Coast Kenya Madagascar Senegal Sudan Tanzania	Bolivia Costa Rica El Salvador Guatemala Haiti Trinidad & Tobago	Afghanistan Burma Malaysia Nepal Sri Lanka Vietnam	Jordan
Group 3: Countries that process a broad range of bulk drugs into dosage forms and manufacture some simple drugs from intermediates.	Algeria Ghana Morocco Nigeria Tunisia	Colombia Ecuador Peru	Bangladesh Indonesia Philippines Singapore Thailand	Iran Iraq Syria
Group 4: Countries that produce a broad range of bulk drugs, from intermediates and manufacture some intermediates using locally produced chemicals.		Chile Venezuela	Pakistan Republic of Korea Turkey	
Group 5: Countries that manufacture most of the intermediates required for the pharmaceutical industry and undertake local research on the development of products and manufacturing processes.	Egypt	Argentina Brazil Mexico	India	

Sources: United Nations Industrial Development Organization, 1978; revised and amended in IMS world Publication Ltd, 1979.

Annex 4

Pharmaceutical Market Shares Held by Domestic and Foreign Firms in Twenty--Five Selected Countries, 1975 (by percentages)

Country	Domestic Share	Foreign Share
Saudia Arabia	0	100
Nigeria	3	97
Belgium	10	90
Venezuela	12	88
Canada	15	85
Australia	15	85
Brazil	15	85
Indonesia	15	85
Mexico	18	82
India	25	75
Iran	25	75
Argentina	30	70
Philippines	35	65
[a]Italy	40	60
[a]Netherlands	40	60
South Africa	40	60
[a]United Kindgom	40	60
[a]Sweden	50	50
[a]France	55	45
Spain	55	45
[a]Germany, Federal Republic of	65	35
[a]Switzerland	72	28
[a]United States	85	15
[a]Japan	87	13
USSR	100	0

Source: Schaumann, 1976:

[a]The home country of at least one of the major pharmaceutical transnational corporations.

The Pharmaceutical Industry and dependency in the Third World, Ibid.

Annex 5

Number of Formulation Plants in Arab Countries and Percentage of Local Consumption produced by these Plants*

Country	No. of Plants in production in 1977	% of local consumption produced
Morocco	15	75
Egypt	10	86
Algeria	3	35
Sudan	3	15
Syrian Arab Republic	3	15
Iraq	1	30
Tunisia	1	25
Jordan	1	20
Kuwait	1	10
Libyan Arab Jamahiriya	0	7
Saudi Arabia	1	3
Yemen	0	0 (1 underway)
United Arab Emirates	0	0
	39	

The total number of plants in operation in the Arab countries = 39. These plants produced 44% of the pharmaceutical dosage units concumed in the Arab countries.

* The information was supplied by ACDIMA personnel.

Annex 6

Production of Synthetic Drugs at El Nasr Co., 1977

(Egypt)

Synthetic bulk products of El Nasr Pharmaceutical Company (excluding intermediates) which have been in past years or are presently manufactured:

Product	Prodn. target 1977 (metric tons per annum)
Sulfanilamide	15
Sulfacetamide	75
Sulfacetamide-Na	20
Sulfaguanidine	75
Sulfadimidine	65
Sulfadimidine-Na	30
Chloramphenicol	12
Chloramphenical palmitate	2
Chloramphenicol stearate	-
Tolbutamide	40
PAS	-
Salicylic acid	10 1)
Na-salicylate	15
Methylsalicylate	-
Salicylamide	50
Acetylsalicylic acid	400
Ca-benzamidosalicylate	60
Ferric ammonium citrate	-
Diiodohydroxyquinoline	-

1) sublimed

Annex 7

Production of Important Essential Oils in Egypt (1977)

Serial No.	Name of the Oil	Area under Cultivation in Feddan	Estimated production of oil in Tons
1.	Geranium oil	11.000	210.00
2.	Jasmine concrete	2876	11.54
3.*	Peppermint and Spearmint oil	446	2.0
4.	French Basil oil	75	1.50
5.	Bitter orange oil	80	0.50
6.	Neroli oil	80	0.50
7.	Majoram oil, Rosemary oil, Rose concrete, Aniseedoil, Fennel oil, Dill oil, Thyme oil, Cumin oil & Garlic oil		small quantities

* Only a part of Peppermint herb is distilled for oil and a major portion is exported as dried herb for medicinal tea.

Annex 8

Pharmaceutical Industry Projects implemented by UNIDO in Arab Countries during 1977-1984

1. UNIDO/IOD/299 - Production Plan for the Arab Pharmaceutical Industry in selected Arab Countries.
2. UNIDO/IOD/155 - Assistance in the establishment of Pharmaceutical Industries, Yemen Arab Republic.
3. UNIDO/IOD/160 - Rapport sur l'Industrie Pharmaceutique en Algérie.
4. AR/SYR/82/001 - Pharmaceutical glass container project, Syria.
5. SI/MOR/82/801 - Conseillers dans le domaine Pharmaceutique, Morocco.
6. UC/PLO/83/066 - A Study of the Pharmaceutical Industry in the West Bank and Gaza strip.
7. SI/RAB/83/801 - Pharmaceutical Industry Advisory Services, ACDIMA.
8. UC/RAF/83/088 - Programme for production of vaccines in Africa - Algeria.

Annex 9

Medicinal Plants available in large quantities in Arab Countries

Serial No.	Name of the plant	Active constituents	Location & source	Quantity* in metric/tons
1.	Liquorice (Glycyrrhiza Glabra)	Glycyrrhizitic Acid Liquorice extract	Iraq, Syrian A.R (wild)	7728.00
2.	Senna-podsand leaves (Cassia acutifalia)	Calcium sennosides	Sudan (wild)	1751.00
3.	Gum Arabic (Acacia senegal)	B.P. grade Gum Arabic	Sudan (wild)	28347.00
4.	Ammi majus	Xanthotoxin (Ammodin)	Egypt (wild & cultivated)	100.00
5.	Ammi visnaga	Khellin	Egypt (wild & cultivated)	200.00
6.	Henbane (Hyoscymus muticus)	Hyoscine, Hyoscymine, Atropine	Egypt Sudan (wild)	Exact figure not known.

* estimate based on export of these raw materials in 1975 (Bureau of Statistics Egypt, Sudan, Syrian Arab Republic, Iraq).

Chammomile. (Matricaria Chammomila) is cultivated on large scale in Fgypt, but the dried flowers are exported to Europe, and there is no scope for processing this material.

Annex 10

Estimated requirements of Phytochemicals and crude extracts in Arab Countries

* Data based on consumption
** in Sudan

Serial No.	Name of the Chemical or extract	Actual Import in Egypt in kgms	Estimated requirement of Arab countries
1.	Steroidal drugs (corticosteroids, sex hormones)	553.37	1665.00
2.	Codeine salts	2750.1	8250.00
3.	Papaverine salts	2060.28	6180.00
4.	Caffeine salts	10689.77	32067.00
5.	Ergotamine tartarate	81.16	258.00
6.	Ergometrine maleate	7.73	23.00
7.	Hyoscymine sulphate	20.00	60.00
8.	Hyoscine hydrobromide	129.4	388.00
9.	Reserpine	12.70	38.00
10.	Colchicine	7.50	22.00
11.	Digoxine	3.44	10.00
12.	Quinine salts	1049.5	3148.00
13.	Quinidine salts	126.5	379.00
14.	Menthol	2303.9	6911.00
15.	Camphor (natural)	1273.5	3820.00
16.	Camphor (synthetic)	2153.1	6459.00
17.	Thymol	8161.5	24484.00
18.	Euclyptol (cineol)	78.16	234.00
19.*	Pyrethrum extract (23%)	---	5000.00
20.	Euclyptus oil	2303.1	6909.00
21.	Peppermint oil	3800.4	11401.00
22.	Extract Belladona (all types)	8043.00	24129.00
23.	Extract buchu	13125.00	39375.00
24.	Cascara sagrada dry	5000.00	15000.00
25.	Extract gentian	21500.00	69500.00
26.	Extract rhubrab	34990.00	104970.00
27.	Extract senega	23000.00	69000.00
28.	Extract lobelia	5080.00	15210.00
29.	Extract hyoscymus	3140.00	9420.00
30.	Extract Ipec	3854.00	11562.00
31.**	Extract stramonium	---	2000.00
32.	Extract liquorice (liquid)	2700.00	7100.00
33.	Extract liquorice (dry)	2100.00	6340.00
34.	Syrup tolu	16000.00	48000.00

Annex 11

Organizational set-up of Pharmaceutical Industry Research & Development Centre